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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TOMOHIDE TAKMI

Appeal 2008-3568
Application 10/726,370
Technology Center 1700

Decided: September 10, 2008

Before CATHERINE Q. TIMM, LINDA M. GAUDETTE, and MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1-9. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

I. BACKGROUND

The invention relates to a nanofiber configured from numerous nanowires (Spec. 2:22-24). Claims 1 and 3-5 are particularly relevant in this appeal:

1. A nanofiber comprised of numerous nanowires, comprising silicon which is oriented and is bundled in a same direction as said nanowires, provided with a space between nanowires, such that the nanofiber has a stem shaped cross-sectional configuration.

3. A nanofiber, comprising:

a plurality of silicon nanowires oriented along a single axis, a portion of the nanofiber forming a joint aligned with the axis, the joint having a diameter less than that of the portions of the nanofiber preceding and following the joint.

4. The nanofiber of claim 3, wherein the nanowires are produced by heating silicon microcrystal grains on the surface of a silicon substrate.

5. The nanofiber of claim 4, wherein the diameter of the nanofiber is approximately equivalent to the size of the microcrystal grain.

On review are the Examiner's rejections of claims 3 and 5 under 35 U.S.C. §112, ¶ 1 as lacking written descriptive support, claims 1-4 and 6-9 under 35 U.S.C. § 102(b) as anticipated by Westwater (US 5,858,862 issued Jan. 12, 1999 to Westwater et al.), and claims 1 and 2 under 35 U.S.C. § 102(b) as anticipated by Okajima (US 5,381,753 issued Jan. 17, 1995 to Okajima et. al.).

II. DISCUSSION

Written Descriptive Support

The Examiner rejects claim 3 as failing to meet the requirements of 35 U.S.C. § 112, ¶ 1 because "[t]he original specification merely provides support for a constriction. There is no support for a joint having a diameter less than the portions preceding and following a joint." (Ans. 3.) The Examiner rejects claim 5 because "[t]he original specification teaches applying grains to form nanowires and the nanofiber is composed of a plurality of nanowires. The grain is approximately the size of the nanowire, not the nanofiber." (Ans. 3.)

Appellant contends that the Specification provides support for the joint diameter limitation of claim 3 at page 10, lines 26-29 and in Figure 4 (Br. 3-4). Appellant further contends that the disputed language of claim 5 is literally supported at page 7, lines 1-2 of the Specification.

The issue on appeal is: has Appellant shown that the Examiner reversibly erred in finding that the language of claims 3 and 5 lacks written descriptive support in the original Specification?

We answer this question in the affirmative.

The test for determining compliance with the written description requirement of 35 U.S.C. § 112, ¶ 1, is whether the disclosure of the application as originally filed would have reasonably conveyed to one of ordinary skill in the art that the inventor had possession at that time of the later claimed subject matter. *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991).

Turning first to claim 3, we find that the portions of the Specification and Figures relied upon by Appellant would have reasonably conveyed

Appellant had possession of a nanofiber with the claimed joint of lesser diameter.

According to the Specification, "Figure 4 shows a photograph taken with an electron microscope of a silicon nanofiber 4 obtained when a heat releasing process is provided after a heating process and then another heating process is provided." (Spec. 10:26-28). The Specification states that "[w]hen the heating is interrupted by the heat releasing period, the diameter of silicon nanofiber 4 will be configured with small joint" (Spec. 10:28-29). From this discussion, one of ordinary skill in the art would understand the "small joint" as referring to the area of lesser diameter midway up the nanofiber depicted in Figure 4.

Moreover, the Specification in the same paragraph states that "[t]he ring shape that is seen in Figure 3 is the interface between the areas of the nanofiber 4 to which surface silicon was supplied and the areas to which it was not supplied in conjunction with melting." (Spec. 11:1-3.) Again, this sentence is referring to what occurs during the heat releasing process. Because the rest of the paragraph is discussing what is seen in Figure 4, and Figure 3 does not show a "ring," one of ordinary skill in the art reading the Specification would understand the "ring" to be the joint of Figure 4. The Specification also describes the joint portion as "shaped like a constriction where the diameter is smaller." (Spec. 4:5-7.)

The Specification reasonably conveys to one of ordinary skill in the art that Appellant was in possession of the claimed joint of lesser diameter than portions preceding and following the joint as recited in claim 3.

Turning to claim 5, as stated by Appellant, the Specification provides support for the claim language at page 7, lines 1-3 where it states that "the

size of silicon microcrystal grain 2 and the diameter of silicon nanofiber 4 become nearly equal and the cross-sectional configuration of the silicon nanofiber 4 easily approximates the cross-sectional configuration of silicon microcrystal grain 2." The Examiner states that "despite the literal support in the specification ..., appellant lacks possession of the invention as claimed because the invention cannot perform as claimed." (Ans. 6.)

We cannot agree with the Examiner. The Specification conveys the concept that the nanowires grow within the grain to form the nanofiber, the nanofiber having a diameter approximating the size of the silicon grain upon which the nanowires grow.

Figures 1a-c show the steps of the method including the placement of silicon grains 2 on the surface of the substrate 1, melting the surface of the substrate to form an orderly arranged crystal face, and causing nanowires to grow which form nanofibers 4 shown in Figure 1c (Spec. 5:3-15). Figure 1c depicts nanofibers 4 as having roughly the same size as the silicon grains 2. The disclosure in the Specification that "the size of silicon microcrystal grain 2 and the diameter of silicon nanofiber 4 become nearly equal and the cross-sectional configuration of silicon nanofiber 4 easily approximates the cross-sectional configuration of silicon microcrystal grain 2" (Spec. 7:1-3) follows logically in the context of the description of the invention as a whole.

The Specification reasonably conveys to one of ordinary skill in the art that Appellant was in possession of the subject matter of claim 5.

We cannot sustain the rejection of claims 3 and 5 under 35 U.S.C. § 112, ¶ 1.

Anticipation

Turning to the rejections of the claims as anticipated, the issue on appeal for each anticipation rejection, i.e., the rejection over Westwater and the rejection over Okajima, is: has Appellant established that the Examiner reversibly erred in finding each and every structure of the claimed nanofiber described in the applied prior art reference?

We answer this question in the affirmative.

"To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997).

Turning first to the Examiner's rejection of claim 1 as anticipated by Westwater, we find that the Examiner has not established that Westwater describes either expressly or inherently the stem shaped cross-sectional configuration required by claim 1.

We interpret claim 1 as limited to "[a] nanofiber comprised of numerous nanowires, [the nanofiber] comprising silicon which is oriented and is bundled in a same direction as said nanowires, [the nanofiber] provided with a space between nanowires, such that the nanofiber has a stem shaped cross-sectional configuration."

To discern the meaning of "provided with a space between nanowires, such that the nanofiber has a stem shaped cross-sectional configuration," we consult the Specification. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) ("Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.").

Appellant's Figure 2 shows the nanofiber in cross-section as closely packed nanowires, and the Specification explains that "numerous nanowires are caused to grow by virtue of elements supplied from the surface area melted of substrate 1 by causing surface segregation to occur in the crystal faces on which were placed microcrystal grains, causing nanofibers 4 having a stem-shaped structure to form." (Spec. 4:20; 5:12-15.) The Specification further states that:

> As Figure 3 shows, while the surface 1 a [sic, 1a] of silicon substrate 1 melts due to heating, this liquefied silicon rises due to the capillary action between silicon wires 5. After this liquefied silicon reaches the tip 5 a of silicon wire 5 it congeals at tip 5 a [sic, 5a]. Silicon nanowires 5 grow due to the repetition of this process and in its turn silicon nanofiber 4 forms. By manufacturing in this way numerous nanowires 5 are prepared from silicon, these nanowires 5 go in the same direct direction, aggregate in a bundle and *nanofiber 4 having a structure provided with gaps between nanowires 5 so that its cross-sectional configuration is stem shaped is obtained.*

(Spec. 10:3-10 (emphasis added).) Figure 3 is a vertical cross-section along line 3-3 in Figure 2 (Spec. 4:21-22). While Figure 3 shows nanowires as spaced apart and not touching, the spaces are bounded outside the plane of the page by other nanowires as shown in Figure 2. Such bounded spaces form the capillaries that allow the melted silicon to rise between the wires. Given the context of the Specification, the language "stem shaped cross-sectional configuration" must be interpreted as limiting the extent of the "spaces" between the nanowires. In context, one of ordinary skill in the art would understand "stem" as used in its ordinary and common meaning: "something resembling or suggesting a leaf or flower stalk." *See* stem. Dictionary.com. *Dictionary.com Unabridged (v 1.1)*. Random House, Inc.

http://dictionary.reference.com/browse/stem (accessed: September 04, 2008). Therefore, we interpret "stem shaped cross-sectional configuration" to mean a cross-section similar to that of a plant stem. Plant stems have structures separated by capillary spaces that can transport fluids in the stem. In order to meet the "stem shaped cross-sectional configuration" required by the claim, the prior art must include nanowires closely spaced such that the spaces between the nanowires are capillary-type spaces.

The Examiner finds that Westwater "teaches silicon nanowires bundled in the same direction with a space between nanowires, such that a nanofiber has a stem shaped cross-sectional configuration, note Figures 3 and 4," and that Westwater's Figure 1C and 3 are similar to Appellant's Figure 1C, and, therefore, Westwater teaches the required cross-section (Ans. 4). However, what is shown in Westwater's Figures 1C and 3 are quantum fine wires 13 completely spaced apart from one another (Westwater, col. 2, ll. 45-46; col. 4, ll. 9-13). The Examiner has not identified any structure in Westwater that is a nanofiber comprised of numerous nanowires with spaces between nanowires such that the nanofiber has a stem shaped cross-sectional configuration. The quantum fine wires 13 of Westwater do not form a nanofiber within the meaning of claim 1.

Claim 3 does not require the nanofiber have a stem shaped cross-sectional configuration. However, claim 3 requires a "joint having a diameter less than that of the portions of the nanofiber preceding and following the joint." The Examiner finds that the middle portion between the flared ends of Westwater's quantum fine wires 13 have the claimed joint as shown in Figure 3 of this reference (Ans. 4). However, a "joint" is the place where two things are joined, it is not an elongated truck or main

portion of an article. Appellant uses the term "joint" to describe the constricted region developed when heating is interrupted in the heat releasing step (stopping silicon supply) as shown in Figure 4. The Examiner has not established that Westwater describes such a joint. We additionally note that the claim requires that a portion of the nanofiber form the joint. The Examiner has not established that the quantum fine wires of Westwater are nanofibers with such a joint. Nor has the Examiner established that the numerous quantum fine wires 13 of Westwater form a nanofiber with a joint.

Turning to the rejection of claims 1 and 2 as anticipated by Okajima, again the Examiner has not established that this reference describes nanofibers with a "stem shaped cross-sectional configuration." The Examiner relies upon Okajima's Figure 1(b) as showing the required cross-section, however, this figure shows needle-like crystals 4 spaced completely apart from each other. These needle-like crystals 4 cannot be said to make up a nanofiber with the capillary-type spacing necessary to give rise to a stem shaped cross-sectional configuration.

The Appellant has established that the Examiner reversibly erred in finding each and every structure of the claimed nanofiber was described by Okajima.

III. CONCLUSION

We do not sustain either the rejections of claims 3 and 5 under 35 U.S.C. § 112, ¶ 1; nor the rejection of claims 1-4 and 6-9 under 35 U.S.C. § 102(b) as anticipated by Westwater; nor the rejection of claims 1 and 2 under 35 U.S.C. § 102(b) as anticipated by Okajima.

IV. DECISION

The decision of the Examiner is reversed.

REVERSED

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